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SFF Committee

SFF-8083 Specification

for

0.8mm Card Edge Connector for 8/10 Gbs Applications

Rev 2.5 January 19 2010

Secretariat: SFF Committee

Abstract: This specification defines the physical interface and general performance requirements of the mating interface for an improved 0.8mm card edge connector for use in applications up to approximately 10 Gbit/s using the upper row of contacts. One such use is as the receptacle connector for the SFF-8432 Improved Pluggable Formfactor when used with SFF-8431 Enhanced 8.5 and 10 Gigabit SFF Pluggable Module aka SFP+.

This specification provides a common reference for systems manufacturers, system integrators, and suppliers. This is an internal working specification of the SFF Committee, an industry ad hoc group.
This specification is made available for public review, and written comments are solicited from readers. Comments received by the members will be considered for inclusion in future revisions of this document.

The description of a connector in this specification does not assure that the specific component is actually available from connector suppliers. If such a connector is supplied it must comply with this specification to achieve interoperability between suppliers.

Support: This specification is supported by the identified member companies of the SFF Committee.

Points of Contact:

Jay Neer
Molex
2222 Wellington Court
Lisle, Il 60532

561-447-2907x3889
jay.neer_at_molex_dot_com

I. Dal Allan
Chairman SFF Committee
14426 Black Walnut Court
Saratoga, CA 95070

408-867-6630
endlcom_at_acm_dot_org

EXPRESSION OF SUPPORT BY MANUFACTURERS

The following member companies of the SFF Committee voted in favor of this industry specification.

Cinch
EMC
Emulex
ETRI
FCI
Finisar
Hewlett Packard
Hitachi GST
JDS Uniphase
Luxtera
Panduit
Sun Microsystems
Toshiba
Tyco
Vitesse Semiconductor

The following SFF member companies voted no on the technical content of this industry specification.

AMCC
Amphenol
Molex

The following member companies of the SFF Committee voted to abstain on this industry specification.

Arista Networks
Avago
Cortina Systems
Dell Computer
Foxconn
Fujitsu CPA
ICT Solutions
LSI
Meritec
NetApp
OpNext
Sandisk
Sandisk/RAD
Seagate
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The user's attention is called to the possibility that implementation to this Specification may require use of an invention covered by patent rights. By distribution of this Specification, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. Members of the SFF Committee, which advise that a patent exists, are required to provide a statement of willingness to grant a license under these rights on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain such a license.

Foreword:

The development work on this specification was done by the SFF Committee, an industry group. The membership of the committee since its formation in August 1990 has included a mix of companies which are leaders across the industry.

When 2 1/2" diameter disk drives were introduced, there was no commonality on external dimensions e.g. physical size, mounting locations, connector type, connector location, between vendors.

The first use of these disk drives was in specific applications such as laptop portable computers and system integrators worked individually with vendors to develop the packaging. The result was wide diversity, and incompatibility.

The problems faced by integrators, device suppliers, and component suppliers led to the formation of the SFF Committee as an industry ad hoc group to address the marketing and engineering considerations of the emerging new technology.

During the development of the form factor definitions, other activities were suggested because participants in the SFF Committee faced more problems than the physical form factors of disk drives. In November 1992, the charter was expanded to address any issues of general interest and concern to the storage industry. The SFF Committee became a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

Those companies which have agreed to support a specification are identified in the first pages of each SFF Specification. Industry consensus is not an essential requirement to publish an SFF Specification because it is recognized that in an emerging product area, there is room for more than one approach. By making the documentation on competing proposals available, an integrator can examine the alternatives available and select the product that is felt to be most suitable.

SFF Committee meetings are held during T10 weeks (see www.t10.org), and Specific Subject Working Groups are held at the convenience of the participants. Material presented at SFF Committee meetings becomes public domain, and there are no restrictions on the open mailing of material presented at committee meetings.

Most of the specifications developed by the SFF Committee have either been incorporated into standards or adopted as standards by EIA (Electronic Industries Association), ANSI (American National Standards Institute) and IEC (International Electrotechnical Commission).

If you are interested in participating or wish to follow the activities of the SFF Committee, the signup for membership and/or documentation can be found at:

www.sffcommittee.com/ie/join.html

The complete list of SFF Specifications which have been completed or are currently being worked on by the SFF Committee can be found at:

ftp://ftp.seagate.com/sff/SFF-8000.TXT

If you wish to know more about the SFF Committee, the principles which guide the activities can be found at ftp://ftp.seagate.com/sff/SFF-8032.TXT

Suggestions for improvement of this specification will be welcome. They should be sent to the SFF Committee, 14426 Black Walnut Ct, Saratoga, CA 95070.

Contents

Figures:

Tables:

1 Scope

This specification defines the terminology and physical requirements for the mating interface and physical characteristics of the improved 0.8 mm card edge connector. The dimensions specified apply to a family of connectors with 20, 30, 50 or 70 contacts. It also defines electrical attributes that distinguish it from the SFF-8084 0.8 mm card edge connector that defines a lower speed connector interface.

Fibre Channel, 10G Ethernet, InfiniBand, other standards, and specifications such as SFP+, define requirements on the characteristic impedance and ability to transmit multi-gigabit signals to and from optical pluggable modules, and in some cases via cable assemblies. When this connector is used in such an application, it is subject to the requirements of those documents.

1.1 Description of Clauses

Clause 1 contains the scope and purpose

Clause 2 contains referenced and related standards and SFF specifications

Clause 3 contains the general description

Clause 4 contains the definitions, abbreviations and conventions

Clause 5 defines the electrical conditions

Clause 6 defines the mechanical conditions

Clause 7 defines the connector dimensions

2 References

The following interface standards and specifications are relevant to this Specification.

2.1 Industry Documents

The following standards and specifications are relevant to this Specification.

ANSI/ASME Y14.5M	Geometric Dimensioning and Tolerancing (GD&T)
EIA 364-06	Contact Resistance Test Procedure For Electrical Connectors
EIA 364-09	Durability Test Procedure For Electrical Connectors And Contacts
EIA 364-13	Mating And Unmating Forces Test Procedures For Electrical Connectors
EIA 364-21	Insulation Resistance Test Procedure For Electrical Connectors Sockets And Coaxial Contacts
INCITS 352:2002	FC-PI (Fibre Channel Physical Interface)
INCITS 404:200x	FC-PI-2 (Fibre Channel Physical Interface - 2
T11/1625D	FC-PI-3 (Fibre Channel Physical Interface - 3
T11/	FC-PI-4 (Fibre Channel Physical Interface - 4
IEEE 802.3	10 Gigabit Ethernet clause 5210GBASE-LRM clause 68
InfiniBand	Architecture Specification Volume 2
T10/1601D	SAS 1-1 (Serial Attached SCSI - 1.1)
INF-8074i	SFP (Small Formfactor Pluggable) Transceiver
SFF-8075	PCI Card Version of SFP Cage
SFF-8084	0.8mm Card Edge Connector
SFF-8410	High Speed Serial Testing for Copper Links
SFF-8431	Enhanced 10 Gigabit Small Formfactor Pluggable Module (SFP+)
SFF-8432	Improved Pluggable Formfactor (IPF)
SFF-8433	IPF (Improved Pluggable Formfactor) Cage
SFF-8434	SFP+ Gerber Files

2.2 SFF Specifications

There are several projects active within the SFF Committee. The complete list of specifications which have been completed or are still being worked on are listed in the specification at ftp://ftp.seagate.com/sff/SFF-8000.TXT

2.3 Sources

Those who join the SFF Committee as an Observer or Member receive electronic copies of the minutes and SFF specifications (http://www.sffcommittee.com/ie/join.html).

Copies of ANSI standards may be purchased from the InterNational Committee for Information Technology Standards (http://tinyurl.com/c4psg).

EIA documents are available at http://global.ihs.com

802.3 Ethernet is available from http://standards.ieee.org/getieee802/802.3.html

The InfiniBand Architecture Specification Volume 2 is available from http://www.infinibandta.org/specs

2.4 Conventions

The ISO convention of numbering is used i.e., the thousands and higher multiples are separated by a space and a period is used as the decimal point. This is equivalent to the English/American convention of a comma and a period.

English	French	ISO
0.6	0,6	0.6
1,000	1 000	1 000
1,323,462.9	1 323 462,9	1 323 462.9

3 General Description

The improved 0.8 mm connection system is based on industry-proven card edge style contacts, which mate with a single wipe, and are very difficult to damage.

0.8 mm Card Edge connectors find their most important application where signals have rise times typically in the range of 35 ps and where positive retention is needed but ease of insertion and removal is also desired. This covers virtually all of the external inter-enclosure applications for gigabit serial applications that use balanced copper media for transmission.

Design goals were minimization of crosstalk and minimum transmission line impedance discontinuity across the connector interface at signaling rates up to 11.1 GBd on the upper row of contacts. The lower row of contacts is rated at signaling rates up to 2.5 Gigabits/second.

The shield (cage) contact (not shown or part of this specification) is required to make contact before any of the signal contacts upon insertion and to break contact only after all contacts are separated upon removal. This ensures that any ground potential differences between enclosures are first exposed to the shield and thereby minimizes the risk of damaging the sensitive input and output stages of the transceivers when the signal contacts are mated.

A cage or latching device (not shown or part of this specification) is required to guide the mating interface (typically a paddle cad) into the connector, provide sufficient wipe on the contact interface, provide a hard stop which prevents the transceiver side from bottoming in the connector, and keeps the paddle card contacts on the connector contacts during use.

This connector is primarily used as a pluggable module connector but can also be used with direct attach cable assemblies.

This specification includes the minimum lengths, widths and positional tolerances of the contacts.

The connector is of a straightforward construction that does not rely on advanced materials or processes, and is physically robust.

Connectors compliant to SFF-8083 are also compliant to SFF-8084, but the reverse is not necessarily true.

4 Definitions and Abbreviations

4.1 Definitions

For the purpose of this specification, the following definitions apply:

Advanced grounding contacts: Connector contacts that make first and break last and are capable of carrying power ground return currents and performing electrostatic discharge. Other terms sometimes used to describe these features are: grounding pins, ESD contacts, grounding contacts, static drain, and pre-grounding contacts.

Alignment guides: Connector features that preposition insulators prior to electrical contact. Other terms sometimes used to describe these features are: guide pins, guide posts, blind mating features, mating features, alignment features, paddle card chamfers and mating guides.

Centerline or CL: A real or imaginary line that is equidistant from the surface or sides of something

Contact mating sequence: Order of electrical contact during mating/unmating process. Other terms sometimes used to describe this feature are: contact sequencing, contact positioning, make first/break last, EMLB (early make late break) staggered contacts, and long pin / short pin.

Frontshell: That metallic part of a connector body that directly contacts the backshell or other shielding material that provides mechanical and shielding continuity between the connector and the cable. Other terms sometimes used to describe this part of a cable assembly are: housing, nosepiece, cowling, and metal shroud.

Maximum component height: Distance from board surface to farthest overall module/connector feature.

Mating side: The side of the connector that joins and separates from the mating side of a connector of opposite gender. Other terms commonly used in the industry are mating interface, separable interface and mating face.

Offset: An alignment shift from the centerline of the connector. Connector contacts may be offset from the CL

Optional: This term describes features that are not required by this specification. However, if any feature defined by this specification is implemented, it shall be done in the same way as defined by the specification. Describing a feature as optional in the text is done to assist the reader. If there is a conflict between text and tables on a feature described as optional, the table shall be accepted as being correct.

Right Angle: A connector design for use with printed circuit board assembly technology where the mating direction is parallel to the plane of the printed circuit board.

Surface mount: A connector design and a printed circuit board design style where the connector termination points do not penetrate the printed circuit board and are subsequently soldered to the surface of the printed circuit board.

Termination side: The side of the connector opposite the mating side that is used for permanently attaching conductors to the connector. Due to pin numbering differences between mating side genders the termination side shall always be

specified in conjunction with a mating side of a specific gender. Other terms commonly used in the industry are: back end, non-mating side, footprint, pc board side, and post side.

Through-hole: A connector design and a printed circuit board design style where the connector termination points penetrates the printed circuit board and are subsequently soldered to the printed circuit board.

4.2 Abbreviations

CL: Centerline

MSA: Multiple source agreement

PCB: Printed circuit board

SFP: Small Formfactor Pluggable

SFP+: Enhanced 8.5 and 10 Gigabit Small Form Factor Pluggable Module

SMT: Surface-mount technology

5 Electrical Specifications

5.1 Electrical Requirements

The electrical and low frequency performance requirements are defined in

TABLE 5-1 ELECTRICAL SPECIFICATIONS AND TEST CONDITIONS

Parameter	Specifications	Test Conditions
Temperature		-20ºC to +85ºC
Humidity		80% RH Maximum
Current	0.5 A/contact	
Voltage	30 V AC/contact	
Low level contact resistance with conductor resistance - Initial	20 milliOhm max change from initial	EIA 364-6: 320 mV DC, 10 mA
Insulation Resistance	1e3 MegaOhm Minimum between adjacent contacts	EIA 364-21: 100 V DC
Dielectric withstanding voltage	No defect between adjacent contacts	300 V DC for 1 minute hold

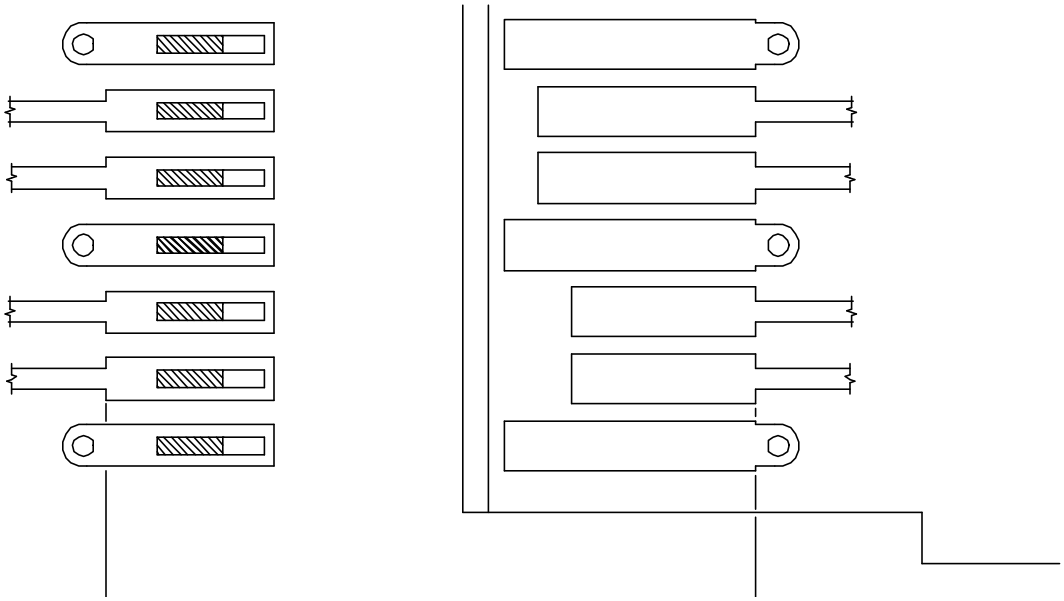
5.2 High Frequency Performance Requirements

The requirements for the high-speed performance are enabled by reference to SFF-8410 High Speed Serial Testing for Copper Links which defines testing methodology. The high-speed performance test methods of SFF-8410 constitute an essential part of this specification.

The signal contacts in the upper row shall meet the requirements of Table 5-2 when adjacent contacts are used in a "ground-signal-signal-ground" configuration.

All electrical data is for a connector in its nominal mated configuration with grounds removed under signal pads. Fixturing effects (test points, traces and other non-required points) are to be de-embedded using industry approved techniques such as Thru-Reflect-Line (TRL), Line-Reflect-Match (LRM), Line-Reflect-Line (LRL), Short-Open-Load-Thru (SOLT) etc. Specific methods are not recommended in this document.

For surface mount connectors, the reference plane for de-embedding is to the end of the recommended solder pads on the host board side, and to the end of the mating pads on the paddle card side. See Figure 5-1 for specific requirements. For through-hole versions, the reference plane on the host board side is either to the edges of the required through-hole vias, or to a plane a short distance further away from the module specified by the connector implementer. The de-embedding plane on the module side is the same as for surface mount connectors.



Host board side footprint.
De-embedding reference plane at end of solder pads as defined in Figure 7-3

Paddle card side contacts.
De-embedding reference plane at end of contact pads as defined in Figure 7-1

FIGURE 5-1 DE-EMBEDDING REFERENCE PLANE

For better performance it is recommended that grounds are cleared from underneath signal pads

TABLE 5-2 CONNECTOR HIGH-FREQUENCY PERFORMANCE REQUIREMENTS

Parameter	Symbol	Type	Value	Units	Conditions
Reference differential impedance	Z_D		100	Ohm	
Reference common mode impedance	Z_C		25	Ohm	
Differential insertion loss	SDDxy	Min	-0.5	dB	0.25 to 5 GHz
		Max	-0.5-5.77*log(f/5GHz)	dB	5.0 to 15 GHz
Differential return loss	SDDxx	Min	-15	dB	0.25 to 5 GHz
		Max	-15+30*log(f/5GHz)	dB	5.0 to 11.1 GHz
Common mode return loss	SCCxx		-12+2.8f	dB	0.01 to 2.5 GHz
			-5	dB	2.5 to 11.1 GHz
Differential near-end crosstalk	$SDDx_bx_a$		TBD	mV_{RMS}	See note 1
Through mode conversion	SCDxy SDCxy		-35	dB	< 3.0 GHz
			-30	dB	< 5.5 GHz
			-26	dB	< 11.1 GHz

Note 1: Measured at with the connector mounted on a SFF–8431 host compliance board and measured to a SFF–8431 module compliance board. The crosstalk source shall have a differential amplitude of 700[1000]mV_{p-p}, a max rise/fall time of 34ps (20% to 80%) and transmitting a PRBS 31 pattern. The bandwidth of the measuring and oscilloscope’s shall be set to a maximum of 12GHz.

6 Mechanical Specifications

6.1 Connector Configurations

The improved 0.8mm card edge connector relies on a receiving body and paddle card, which are the primary elements of a connector used for e.g. the SFP+ application.

The primary elements provide a flexible means to implement solutions for diverse applications e.g., direct board-to-board implementations can incorporate the plug into the side of one board and mate directly to a receiving body on the other.

Figure 6-1 is an example, which illustrates one style of receiving body and how they become receptacles to receive the plug when encapsulated by the shell that is designed for an unshielded connector application.

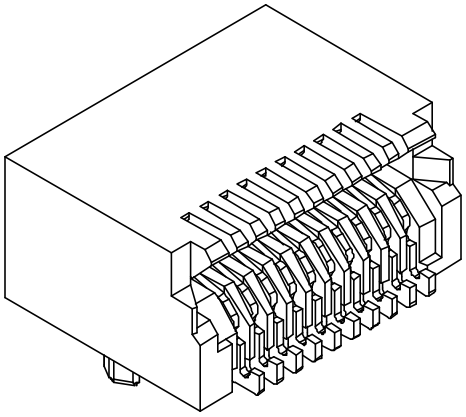


FIGURE 6-1 GENERAL VIEW OF RIGHT-ANGLED BODY RECEPTACLE

SFF-8432 is an example of the definition of a pluggable module or cable plug that incorporates the paddle card. It also defines the interface to a separate cage (front shell) which is used to encapsulate the receiving body to form a complete receptacle for use in shielded applications.

The cage provides guidance and retention for the cable plug or pluggable module, and absorbs the stress imposed by insertion and removal of the plug or module. This protects the quality of the solder joints between the body and host board.

SFF-8433 and SFF-8443 define various cage configurations that could apply to an SFP+ application.

6.2 Mechanical Requirements

The mechanical requirements are listed in Table 6-1.

TABLE 6-1 MECHANICAL REQUIREMENTS

Items	Conditions	Acceptance Limits				Unit
		20 Ckt	30 Ckt	50 Ckt	70 Ckt	
Durability for Connector	EIA 364-09	100	100	100	100	Cycles
Durability for Mating Paddle Card	EIA 364-09	50	50	50	50	Cycles
Mating Force	EIA 364-13: Measurement speed: 12.7 mm per minute maximum	30 Max	35 Max	45 Max	55 Max	N
Un-mating Force	EIA 364-13: Measurement speed: 12.7 mm per minute maximum with retention latch disengaged	20 Max	25 Max	35 Max	45 Max	N

6.3 Contact Sequencing

To combat electrostatic discharge, static drain, protect signal pins, or for other purposes, it may be desirable that during module/cable insertion some contacts make contact first and that during extraction these contacts break last. This function can be achieved with contact sequencing. Figure 6-2 shows an example where first the advanced grounding contacts make contact with the board side contacts and then the power contacts make contact and that the signal pins make contact after ground and power has been established. During extraction the reverse process happens. For details on the sequencing dimensions see Figure 7-1

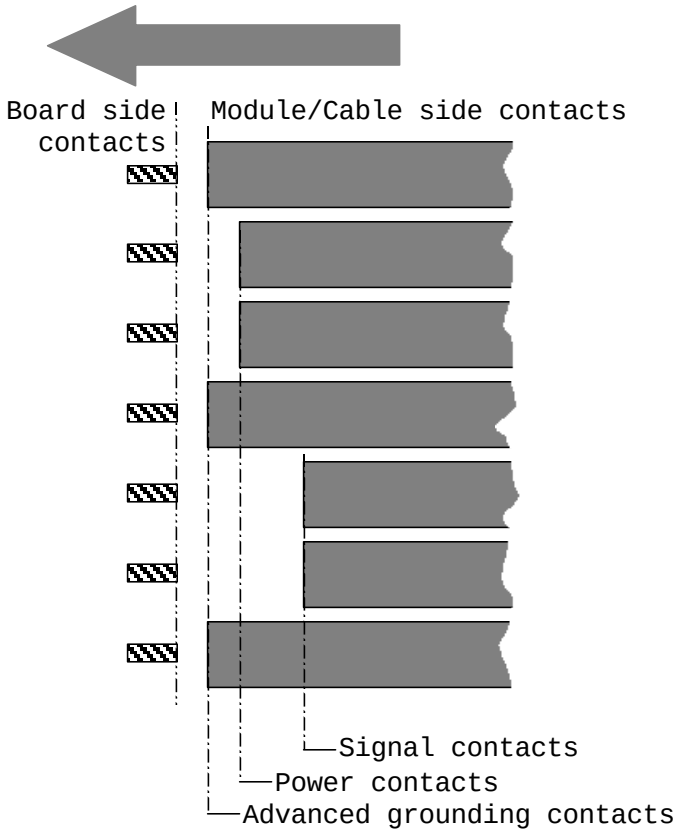


FIGURE 6-2 CONTACT SEQUENCING

6.4 Contact Numbering

The contact numbering is shown in Table 6-2 for the various sizes of connector. For location of contacts A1 and B1, see Figure 7-1 and Figure 7-2

TABLE 6-2 CONTACT NUMBERING

20 Contacts		30 Contacts		50 Contacts		70 Contacts	
1	20	1	30	1	50	1	70
2	19	2	29	2	49	2	69
3	18	3	28	3	48	3	68
4	17	4	27	4	47	4	67
5	16	5	26	5	46	5	66
6	15	6	25	6	45	6	65
7	14	7	24	7	44	7	64
8	13	8	23	8	43	8	63
9	12	9	22	9	42	9	62
10	11	10	21	10	41	10	61
		11	20	11	40	11	60
		12	19	12	39	12	59
		13	18	13	38	13	58
		14	17	14	37	14	57
		15	16	15	36	15	56
				16	35	16	55
				17	34	17	54
				18	33	18	53
				19	32	19	52
				20	31	20	51
				21	30	21	50
				22	29	22	49
				23	28	23	48
				24	27	24	47
				25	26	25	46
						26	45
						27	44
						28	43
						29	42
						30	41
						31	40
						32	39
						33	38
						34	37
						35	36

7 Connector Dimensions

The dimensioning conventions are described in ANSI-Y14.5M, Geometric Dimensioning and Tolerancing. All dimensions are in millimeters.

Dimension related requirements for the connector system addressed in this document are specified in the tables and figures in this clause.

7.1 Paddle Card

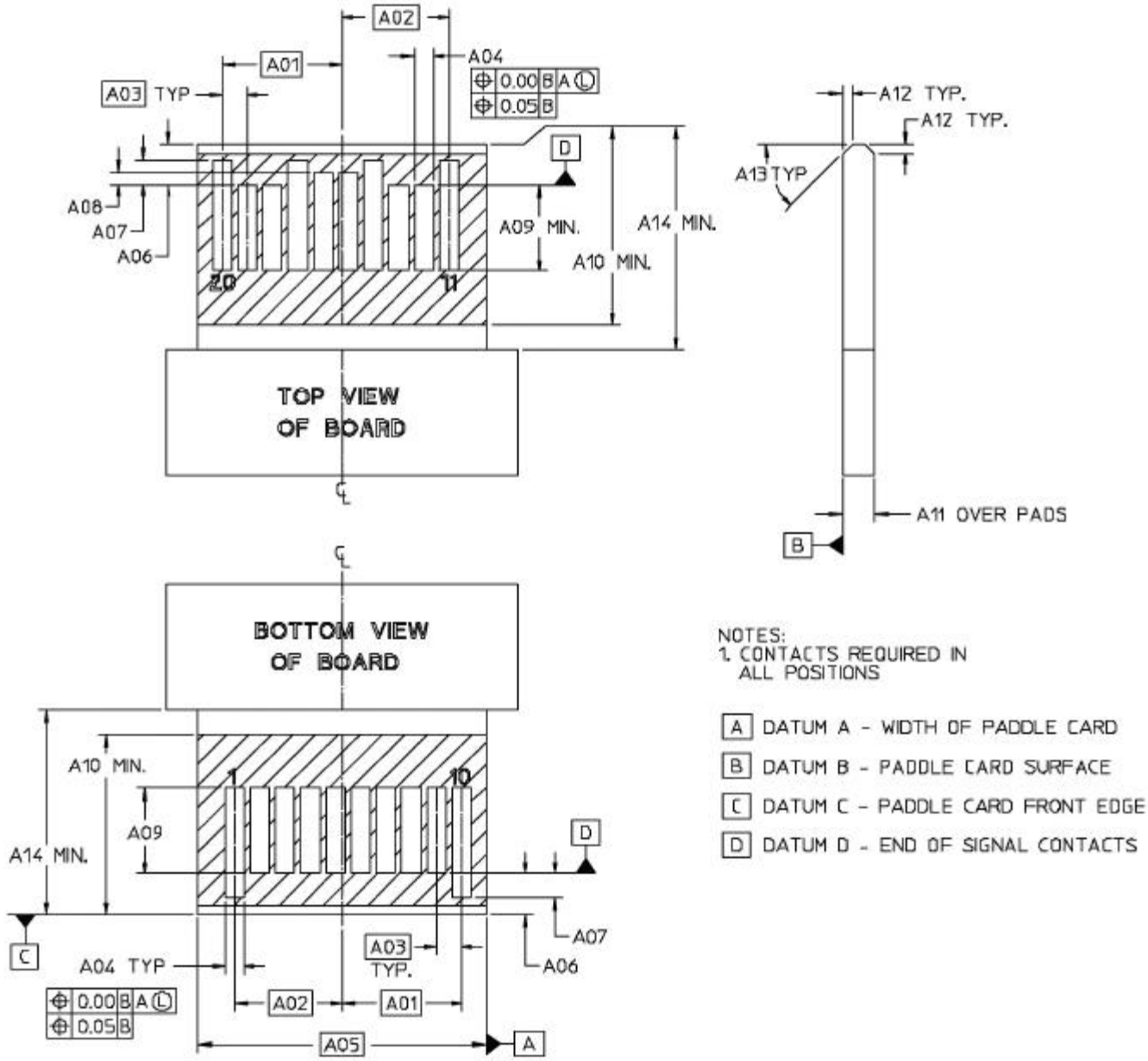


FIGURE 7-1 PADDLE CARD

TABLE 7-1 PADDLE CARD

Designator	Description	20	30	50	70	Tolerance
A01	CL to last	3.80	5.80	9.80	13.80	Basic
A02	CL to first	3.40	5.40	9.40	13.40	Basic
A03	Contact pad pitch within row	0.80	0.80	0.80	0.80	Basic
A04	Pad width	0.60	0.60	0.60	0.60	±0.05
A05	Paddle card width	9.15	12.15	21.15	29.15	±0.15
A06	End of paddle card to datum D	1.30	1.40	1.40	1.30	±0.10
A07	Start of ground pad to datum D	0.80	0.90	0.90	0.80	±0.05
A08	Start of power pad to datum D	0.40	0.40	0.40	N/A	±0.05
A09	Length of signal pad	2.20	1.55	1.55	2.20	Minimum
A10	Length of component/Solder Mask	5.50	5.50	5.50	5.50	Minimum

	keep-out area					
A11	Paddle card thickness	1.00	1.00	1.00	1.00	±0.10
A12	Paddle card end chamfer	0.30	0.30	0.30	0.30	+0.10/ -0.20
A13	Paddle card end chamfer angle	45°	45°	45°	45°	Reference
A14	Length from front edge to shoulder	6.00	6.00	6.00	6.00	Minimum

7.2 Board Side Connector

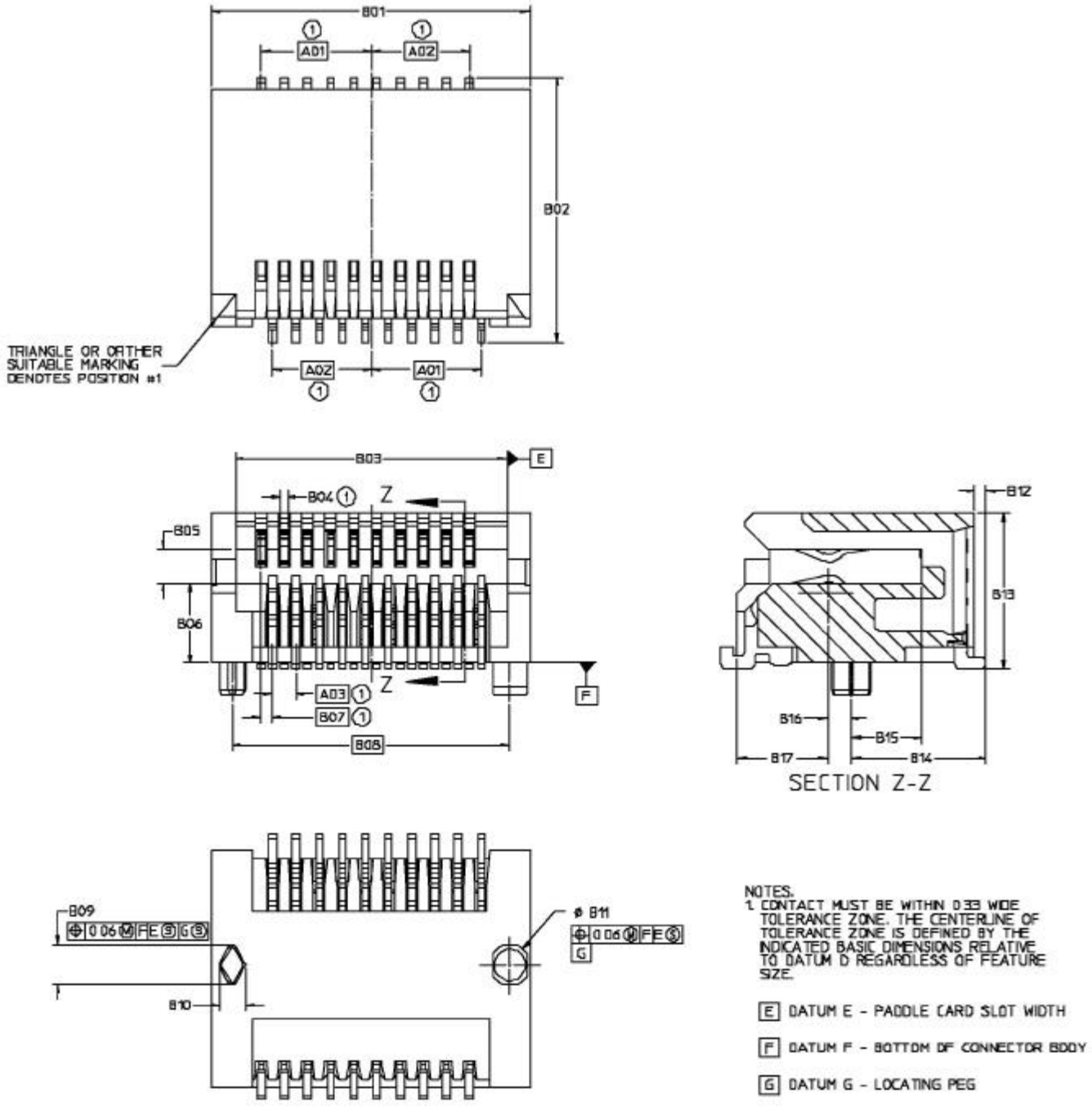


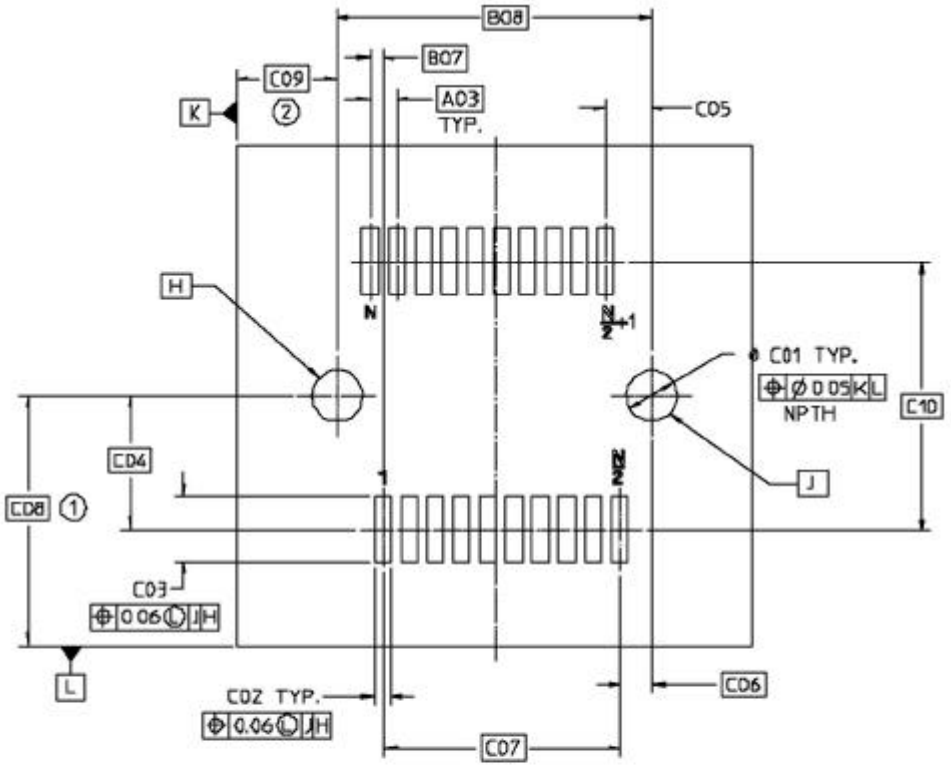
FIGURE 7-2 BOARD SIDE CONNECTOR

TABLE 7-2 BOARD SIDE CONNECTOR

Designator	Description	20	30	50	70	Tolerance
A01	CL to last	3.80	5.80	9.80	13.80	Basic
A02	CL to first	3.40	5.40	9.40	13.40	Basic
A03	Contact pitch within row	0.80	0.80	0.80	0.80	Basic
B01	Overall width	11.20	15.20	23.20	31.20	Maximum
B02	Overall depth	9.20	9.20	9.20	9.20	Maximum
B03	Paddle card slot width	9.40	13.40	21.40	29.40	±0.05
B04	Contact tolerance zone	0.33	0.33	0.33	0.33	Maximum
B05	Paddle card slot height	1.35	1.35	1.35	1.35	Maximum
B06	Paddle card slot to datum F	2.75	2.75	2.75	2.75	±0.15
B07	Contact pitch row to row	0.40	0.40	0.40	0.40	Basic
B08	Peg to peg	9.60	13.60	21.60	29.60	Basic
B09	Peg height	1.40	1.40	1.40	1.40	±0.05
B10	Peg width	0.90	0.90	0.90	0.90	Reference
B11	Peg diameter	1.40	1.40	1.40	1.40	±0.05
B12	Housing to solder foot	0.41	0.41	0.41	0.41	Reference
B13	Overall height	5.40	5.90	5.90	5.90	Maximum
B14	Peg CL to solder foot	4.65	4.65	4.65	4.65	Reference
B15	Peg CL to card slot	2.43	2.43	2.43	2.43	Minimum
B16	Peg CL to contact CL	0.70	0.70	0.70	0.70	±0.15
B17	Housing Front to contact CL	2.30	2.30	2.30	2.30	±0.15

Note: Solder footprint configuration shall conform to the footprint defined in 7.3

7.3 Board Side Connector Footprint



NOTES:
1. GROUNDS ARE CLEARED UNDER SIGNAL PADS
2. DATUMS AND BASIC DIMENSIONS TO BE ESTABLISHED

[H] DATUM H - CONNECTOR LOCATING PEG

[J] DATUM J - CONNECTOR LOCATING PEG

[K] DATUM K - SIDE OF FOOTPRINT

[L] DATUM L - FRONT OF FOOTPRINT

FIGURE 7-3 BOARD SIDE CONNECTOR FOOTPRINT

TABLE 7-3 BOARD SIDE CONNECTOR FOOTPRINT

Designator	Description	20	30	50	70	Tolerance
A03	Contact pitch within row	0.80	0.80	0.80	0.80	Basic
B07	Contact pitch row to row	0.40	0.40	0.40	0.40	Basic
B08	Peg to peg	9.60	13.60	21.60	29.60	Basic
C01	Locator peg hole diameter	1.55	1.55	1.55	1.55	±0.05
C02	Pad width	0.50	0.50	0.50	0.50	±0.03
C03	Pad length	2.00	2.00	2.00	2.00	±0.05
C04	Peg hole CL to pad CL	4.10	4.10	4.10	4.10	Basic
C05	Locator peg hole CL to pad CL	1.40	1.40	1.40	1.40	Reference
C06	Locator peg hole CL to pad CL	1.00	1.00	1.00	1.00	Reference
C07	Pad CL to pad CL within row	7.20	11.20	19.20	27.20	Basic
C08	Datum H to locator peg hole CL	See Note 2				Basic
C09	Datum J to locator Peg Hole CL	See Note 2				Basic
C10	Row CL to row CL	8.20	8.20	8.20	8.20	Basic